Computers, Components and Peripherals

Reuse and Recycling in California

This document is provided by the California Integrated Waste Management Board (CIWMB) and the California Materials Exchange (CalMAX). It is designed to assist corporate and small business owners with information on the reuse, recycling and refurbishment of outdated computers, monitors and peripherals. The Board is distributing this information in an effort to increase public awareness and knowledge.

COMPUTER REUSE AND RECYCLING

A World of Technology?

America is in the midst of an electronic revolution. According to the consumer Electronic Manufacturers' Association, growth in computer sales has increased 23% a year since 1985 to 12.8 million units sold in 1998. An estimated 44% of all households now own personal computers, and virtually every business depends on computer technology in some way or another.[1]

With ever increasing technological advances, computers and other electronic products are becoming outdated at an alarming rate. For every three computers purchased this year, two will become obsolete,[2] for a national estimate of 8.5 to 10 million old computers. Some studies indicate the numbers are even significantly higher.[3] This trend of obsolescence is likely to continue given the growth in digital and wireless technologies.

Did You Know . . .

10% of Computers are Recycled or Reused.

15% are Landfilled.

75% are Stored or Stockpiled![4]

What's Being Done with Old Computers?

The good news is that the reuse and recycling rate of electronic equipment is on the rise. Once motivated by the value of the precious metals, computer recyclers and reclamation centers now offer a diverse range of services to corporations, government, and universities faced with the cost, environmental concerns and liability associated with replacing their computers every few years. The developing infrastructure is spurring new businesses that take old and unwanted computers, printers, printers, monitors and peripherals, and repair or upgrade for reuse or recycling.

Markets for Old Computer & Peripherals:

1. **Refurbishment, Resale and Donation of Old Systems**
   Upgrading and repairing whole computer systems for reuse.

2. **Reclamation and Reselling of Components**
   Dismantling systems to upgrade and repair individual components for reuse.

3. **Salvaging and Recycling of Materials**
   Reclaiming recyclable materials from unusable components for recycling in traditional materials markets.

Donation of Government Owned Surplus Equipment

The State of California, Department of General Service's Surplus Property Program (SPP) provides an electronics reuse infrastructure for state agencies. The SPP receives, stores, and reissues salvaged and surplus property, including electronic equipment, from California State agencies, federal agencies and programs. The materials are also available to the general public at reduced costs. For more information, visit the SPP web site at: http://www.pd.dgs.ca.gov/

COMPONENTS AND PROCESSORS

Components, By Any Other Name . . .

HARD DRIVES - are reused or recycled for their metal.

MEMORY CHIPS - are sold for reuse or recycled for precious metals.

PROCESSORS - are sold for reuse or recycled for precious metals. (Hard Drives, chips and processors comprise the Central Processing Unit (CPU) of a personal computer.)

INTEGRATED CIRCUIT BOARDS - are recycled for precious metal recovery. About 3 percent of the metals in a PC are precious - 1 percent alone is gold. Circuit boards contain a number of organic and metallic compounds that are considered hazardous.

METALS - from a unit's motor, frame, wires and other components are recyclable.

KEYBOARDS - contain small component parts of metal and plastic and make recovery difficult.

MONITORS - have cathode-ray tubes (CRTs) that contain lead in the picture tube (glass). They also contain small quantities of cadmium and other metals. CRT's are sometimes characterized as hazardous waste (see section on CRTs) and are costly to recycle. The electron gun and other components can be removed from dead CRTs and the glass tube can be processed for reuse. The CRT glass can also be shipped to lead smelters, where the lead in the glass can be removed and recovered.

PLASTIC HOUSINGS - include metals, glues, laminates, mixtures of different plastic types, and other contaminants making plastic difficult to recover for recycling.[5]

Directories and Materials Exchanges

An effective tool for diverting discarded electronics from the waste stream are regional reuse directories and material exchanges. Check with your city or county waste management/recycling office for further information. See *Resources* (page 7 - 8) for details:

- The California Materials Exchange (CalMAX)
- Regional MiniMAX's - See CalMAX Web Site
- The Bay Area Electronic Recycling Guide
- Put It To Good Use, Los Angeles
- Kidsource Online

WHO IS PROVIDING THESE SERVICES?

Nonprofit Computer Recycling & Reuse Operations

Old computers and related equipment are collected and repaired for donation to nonprofit organizations, public and private schools and libraries, economically disadvantaged individuals and developing countries. A smaller number of nonprofit computer operations also provide dismantling services for computers that are not upgradable or reusable. The components are resold or the materials are recycled for their scrap value.

Corporate-Run Computer Reclamation Centers

These centers provide a full line of computer recycling services for equipment manufacturers, large corporations, government agencies, universities and other large computer users. Services include guarantees for the destruction of proprietary information from hard drives, and insurance coverage for the disposal of the equipment.

For-Profit Private Computer Recycling & Reuse Operations

For-profit computer operations are generally larger in scale than nonprofit operations. The upgradable and reusable systems and components are sold to brokers and original equipment manufacturers while the unusable components are dismantled for the recyclable materials.

MARKET TRENDS
THE WAVE OF THE FUTURE

The Times, They Are A-Changing!

Until five years ago, computers were salvaged for the value of their precious metals. However, the industry has changed in the past five years due to declines in the chip market resulting from technological advances. Manufacturers now use less than 90 percent of the precious metals in manufacturing printed circuit boards. Technological advances in memory chips also require less materials and yield less recovererd value when recycled. As a result, profits once realized from the sale of precious metals (platinum, palladium, gold and silver) no longer offer the same incentive to recyclers. Today electronic recyclers have expanded and diversified services from simply selling electronics scrap for profit, to selling a variety of services for businesses related to the expansion, repair, dismantling, and salvaging of business computers.[6]

It's now common knowledge that old computers have little to no resale value given the rapidly changing technology of today. In fact, outdated computers can be considered a liability rather than an asset due to the environmental concerns of disposal. Roughly 72 percent of all retired electronic products are simply stored for an average of three years. Containing higher levels of precious metals, older equipment can be difficult to recycle since it has less reusable parts and also contains higher levels of contaminants, such as lead.[7] For business, economics are not a primary motivator for electronics recycling. Environmental concerns and liability are probably the most significant motivators.[8]

So, get rid of those stockpiled computers! Finding a place **now** for that old computer makes more sense, environmentally, economically, and socially than keeping it around. Resources are available to assist businesses in placing outdated electronic equipment.

California Legislation Stimulates Computer Donations

The *21st Century Classrooms Act for Private Technology Investment* was signed into law August 5, 1997 as part of the larger Taxpayer Relief Act of 1997. This act allows companies that donate computers to schools within two years of purchase to enhance charitable contribution deductions on those computers beginning in tax year 1998. The act was inspired by the need to equip schools for the next century. The increased deduction alters the economics for companies to upgrade every two years and is expected to stimulate a flood of donated computers. For more information on Taxpayer Relief Act of 1997 or the 21st Century Classrooms Act for Private Technology Investment, see:

**http://www.detwiler.org/deduct.html**

HAZARDOUS REGULATIONS AND RECYCLING

Electronic Components - Recyclable & Hazardous!

Computers contain several dozen distinct materials including glass, plastics and a variety of metals ranging from aluminum and steel to precious metals such as gold and copper. Some of these metals are federally regulated hazardous materials (e.g., lead, chromium, beryllium, mercury, cadmium, nickel and zinc). If improperly managed, hazardous and toxic materials may be released into the environment.

Monitors and Cathode Ray Tubes (CRTs)
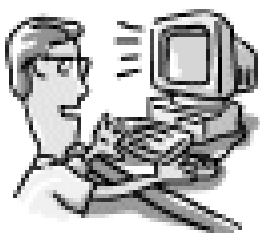
The front glass on a computer monitor is called a cathode-ray tube (CRT). The CRT contains lead to protect the viewer from radiation, and as such the CRT glass in computer monitors is classified as a hazardous waste for disposal under the Environmental Protection Agency's Resource Conservation Recovery Act (RCRA, 42 USC 6924). Monitors are also known to contain smaller quantities of cadmium and other metals as well.

CRTs from computer monitors can be recycled. However, they should be recovered and handled carefully. Domestic markets can remove the electron gun and other components from CRTs and process the glass tube for reuse. The CRT glass can also be shipped to lead smelters, where the lead in the glass can be removed and recovered. The glass can be used as fill for roadbeds or used as a material additive in the cement kiln process. The optimal closed-loop solution for old CRTs is to turn old CRT glass into new CRTs.[9]

The U.S. EPA's Common Sense Initiative (CSI) Computers and Electronics Sector is working to remove federal regulatory barriers to environmentally sound recycling of CRTs. Its work is currently focused on converting CRT glass back into CRT glass. [10]

Regulations Concerning CRT's

Small businesses generating less than 220 pounds do not have to treat CRTs as hazardous waste. However, businesses generating more than 220 pounds per month of computer or TV monitors must treat CRTs as hazardous waste.[11] In general, businesses must treat CRTs as hazardous waste unless they are intact and part of intact sets or monitors. Current efforts through U.S. EPA's Common Sense Initiative have focused on exempting CRT processors from treating CRTs as hazardous waste. This change would make it more economical to recycle CRTs.

For more information pertaining to CRT regulation in California, contact the Department of Toxic Substance Control's Regional Office in Long Beach at (310) 590-4868. For more information on the status of federal regulations pertaining to CRTs, contact U.S. EPA's Office of Solid Waste at:

http://www.epa.gov/swerrims/index.htm

Printed Circuit Boards

Printed circuit boards are complex in their chemical composition. The major groups of materials can be broken into three categories: organic materials, ceramics and metals. They also contain hazardous metals such as chromium, lead, beryllium, mercury, cadmium, nickel and zinc, with significant variations depending on the board. In addition to metals, printed circuit boards also contain bromine and antimony as a flame-retardant. Some of the laminates in printed circuit boards may also contain flame-retardant in the resin.[12] Printed circuit boards are either resold for reuse, or processed for their precious and base metals.

DESIGN FOR THE ENVIRONMENT

Historically, computer and electronic manufacturers' interest primarily resided in the manufacturing and marketing of their products. The end-of-life management issues (demanufacturing, reselling, recycling, and disposal) were rarely considered in product design. However, this trend may be changing. Spurred by consumer pressure over environmental issues, anticipation of government regulations mandating recycling, and concern over liability from improperly disposed wastes, electronics manufacturers have begun efforts to take responsibility for the environmental impact of their products.[13] Computer manufacturers (Apple, HP, IBM) now have Design for the Environment (DFE) or Green Design programs that are beginning to address environmental concerns at the design stage. These programs are concerned with issues of manufacturer responsibility, especially in relation to designing standardized parts and components for ease of reuse, upgradability, recyclability, and environmentally safe disposal. Examples of said activities include:
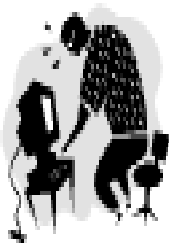
- Minimize number of parts to simplify upgrade, servicing and recycling.
- Design products with standardized parts and modular components.
- Design for reuse and upgrade - avoid obsolescence and extend product life span.[14]
- Minimize the use of toxic materials and support materials recovery.
- Use recycled materials in the manufacturing process to help "close the loop."
- Label all parts, particularly plastics to enhance materials recovery.
- Provide consumers with electronic product's environmental performance.[12]

Definitions

Business Electronics – Business systems with electronic circuitry that process and display information such as computers, printers, monitors, and fax machines.

Common Sense Initiative (CSI) – The US EPA's CSI encourages the use of common sense, innovation, and flexibility in order to achieve a cleaner environment.

Design for Disassembly (DFD) – To design a product in a way that it can be taken apart quickly.

Discard – Products that are sold and donated for further use, returned, or disposed of by the initial consumer.

End-of-life Management (EOL) – The final management of electronic products. May include disposal, recycling or sale of scrap parts. It does not include reuse, since a reusable appliance has not reached the end of its useful life.

Extended Product/Producer Responsibility (EPR) – The manufacture's responsibility for the product when it reaches it's End-of-life Management.

Information Technology (IT) – Electronic equipment used for information retrieval, e.g., computers, servers, peripherals, etc.

Life Cycle Analysis/Assessment (LCA) – The significance of every aspect of a product's impact on the environment from its creation (and raw materials extraction) to eventual disposal (including reuse and recycling).

Manufacture Responsibility – same or similar to EPR.

Product Responsibility Mandates – Laws and regulations requiring manufacturers to develop programs that meet certain environmental goals.

Product Stewardship Policies – Policies developed by manufacturers to guide internal environmental management and in implementing DFE principles.

Shared Responsibility – Manufacturers should not have to bear the full price to reuse, recycle or dispose of the product. Therefore, all involved need to bear some cost of disposing of the product at the end-if-life.

Take Back Programs – Collection systems that allow for the return of certain products to the manufacturer or to their intermediary. The European community is leading the world in mandated take back programs, e.g. cars, packaging, computers.[15]

RESOURCES

NONPROFIT COMPUTER RECYCLING CENTERS

Alameda County Computer Resource Center (ACCRC)
Oakland, CA.
Contact: James Burgett
(510) 434-1325
(510) 434-1327
mcrc@pacbell.com
Accepts and refurbishes and recycles donated computers, and distributes pentium level rebuilt computers to nonprofits and qualifying individuals. Unuseable components are sold to secondary recyclers. Mainframes accepted.

California Area Resources for Educators (C.A.R.E.)- Foodlink
Sacramento, CA.
Shireen Duncan
(916) 231-1221
Accepts and refurbishes used computers, and distributes to educators and in Northern California.

Computers For Education & Computer Recycling
Santa Rosa, CA.
(707)570-1600
www.crc.org
Accepts all IBM computers, clones and Macintosh systems. Donates to schools.

California Human Dev. Corp Center for Employment Training (CET)
Santa Rosa, CA.
(707) 523-1155
Accepts all computers to train adults in electronic assembly.

Detwiler Foundation, Inc. Computers For Schools Program
La Jolla, CA.
Martha Baker
martha@detwiler.org
(619) 456-9045
www.computersforschools.com
Accepts out-dated computers, components, diskettes, hard drives, printers and software for donations to schools program. Mainframes not accepted.

L.A. Shares
Los Angeles, CA.
Bert Ball
(213) 485-1097
lashares@aol.com
Accepts and donates working only computers to nonprofits. Provides collection service.

FOR-PROFIT COMPUTER RECYCLING CENTERS

Berman's Diversified Industries
San Jose, CA.
(408) 955-7908
Ted Caliouette ted@berman.com or Jeff Holleran jeff@berman.com
Free local pick-up of used computers. Auctions for useable computers, nonmarketable computers and proprietary materaisl are recycled.

Oakland Technology Exchange
Oakland, CA.
(510) 879-1904
Rory Wilcove
wilcovr@ouds.k12.ca.us
Accepts donations of computers (PC's 386 +) and peripherals for reuse by students. Pick-up service is available for large quantities.

United Datatech
Santa Clara, CA.
(408) 998-0700
Richard or George Peterson
richardp@uniteddatatech.com
Complete electronic recycling service, computer refurbishing, reselling and disposal.

Urban Ore
Berkeley, CA.
Aris Voulkos, Arts and Media Dept. (510) 559-4456
Accepts and salvages computer electronics and other materials. Usable computers are sold, unmarketable computers are disassembled or sold to secondary recyclers.

CORPORATE-RUN RECLAMATION CENTERS

Fry's Electronics
San Jose, CA.
John Gamet (408) 487-1059
Accepts and donates computers.

Hewlett-Packard
Roseville, CA.
Renee St. Denis (916) 785-8034
Chris Altobell (916) 785-7415
In conjuction with MicroMetallics Corporation, Hewlett Packard provides complete on-site recycling services for customers.

Panasonic
Secaucus, New Jersey
Richard King (201) 392-4199
KingR@Panasonic.com
Involved with EPA CIS computer recycling. Call for information.

Unisys Corporation
Phoenix, AZ.
Thomas Bartel (602) 224-4221
tombartel@unn.unisys.com
IInvolved in computer recycling pilot in San Jose and the EPA CSI workgroup.

RESOURCES

REFERENCES

Bay Area Electronic Recycling: From the Corporate Office to the Curbside.
Materials For The Future Foundation
Sheila Davis (415) 561-6530 #18
www.materials4future.org
Featuring information on electronics, componets, CRTs, and plastics reuse and recycling. Also featuring local reuse operations and collection efforts.

Plug Into Electronics Reuse
Institute for Local Self Reliance
Washington, DC.
Brenda Platt (202) 232-4108
ilsr@igc.org
Highlights the benefits of electronics reuse, reuse enterprises, collection strategies, government policies, and profiles of reuse operations.

US EPA Office of Solid Waste
Washington, DC.
Clare Lindsay (703)-308-7266
Active in electronics recycling.

Put It To Good ReUse LA!
City of Los Angles, CA
(213)847-1444
A directory of donation and reuse opportunities for Los Angeles.

WEB SITES

California Material Exchange (CalMAX)
(916) 255-2369
www.ciwmb.ca.gov/calmax/
Publishes a quarterly catalog and maintains a Web site of available and wanted materials throughout the state. Links.

KidSource Online
www.kidsource.com/kidsource/pages/Donation.html
EDGE (Equipment Donation and Grants to Education). Matches schools with donated computer equipment provided by individuals and corporations.

WEB SITES (CONT'ED)

PEP - Resources for Parents, Educators and Publishers
www.microweb.com/pepsite/Recycle/recycle_index.html.
Provides state, national, and international directories of agencies that facilitate donations of used computers.

Second Chance Week - Local Government Commission
(916) 448-1198
www.choose2reuse.org
Online resources to assist local communities with the coordination of local reuse promotions and other activities.
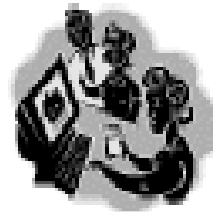
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(12) Management of Waste Electronic Appliances. Minnesota Office of Environmental Assistance, August 1995.

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